

REMARKS

The Examiner is thanked for the thorough examination of this application. The Office Action, however, has tentatively rejected all pending claims 29-34 and 36-38.

35 U.S.C. 102(b)

Claims 29, 31, 37-38 were tentatively rejected under 35 U.S.C. 102(b) as allegedly anticipated by Marrs (US patent 5,795,818). Applicants respectfully traverse the rejections for at least the reasons discussed below.

In this regard, Marrs discloses an integrated circuit chip to substrate interconnection and method. Specifically, referring to Fig. 8, Marrs teaches a metallization 502 disposed beside an isolation layer 601, and a ball bond bump 312 connects the chip 201 and the substrate 501.

In contrast, independent claims 29 and 37-38 recite (respectively):

29. A solder bump for interconnection of flip chip devices comprising:
a semiconductor surface;
at least one contact pad over said semiconductor surface;
a passivation layer over said semiconductor surface, said passivation layer exposing said at least one contact pad;
an Under-Bump-Metallurgy (UBM) layer over said layer of passivation
and said at least one contact pad, lateral dimension of the UBM layer being limited to be within lateral dimension of the at least one contact pad; and
at least one solder compound overlying the UBM layer, wherein the solder compound comprises a flat top surface, a flat bottom surface and convex sidewalls, and the flat top surface is greater than the flat bottom surface before connecting to other components.

37. A solder bump for interconnection of flip chip devices comprising:
a semiconductor surface;
at least one contact pad over said semiconductor surface;
a passivation layer over said semiconductor surface, said passivation layer exposing said at least one contact pad;
an Under-Bump-Metallurgy (UBM) layer over said passivation layer and
said at least one contact pad, lateral dimension of the UBM layer being limited to

a size approximately the same as lateral dimension of the at least one contact pad; and

at least one solder compound overlying the UBM layer, wherein the solder compound comprises a flat top surface, a flat bottom surface and convex sidewalls, and the flat top surface is greater than the flat bottom surface before connecting to other components.

38. A solder bump for interconnection of flip chip devices comprising:
a semiconductor surface,
 at least one contact pad over said semiconductor surface;
 a passivation layer over said semiconductor surface, said passivation layer exposing said at least one contact pad;
an Under-Bump-Metallurgy (UBM) layer over said passivation layer and
 said at least one contact pad; and
at least one solder compound overlying the UBM layer, wherein the solder compound comprises a flat top surface, a flat bottom surface and convex sidewalls, and the flat top surface is greater than the flat bottom surface before connecting to other components.

(Emphasis added.)

Clearly, Marrs does not teach or suggest the claimed “a semiconductor surface”, “an Under-Bump-Metallurgy (UBM) layer over said passivation layer” or “at least one solder compound overlying the UBM layer, wherein the solder compound comprises a flat top surface, a flat bottom surface and convex sidewalls, and the flat top surface is greater than the flat bottom surface before connecting to other components”.

Indeed, Marrs only appears to teach a metallization 502 disposed beside an isolation layer 601, and a ball bond bump 312 connects the chip 201 and the substrate 501.

First, the substrate 501 is not a semiconductor. As Marrs described (see col.11, lines 12-22), “The solder balls are used to make the electrical connection between the IC chip (this means the chip 201) and the electrically conductive material (this means the metallization 502) formed on higher level components such as a printed circuit board (PCB, this means the substrate 501).” Therefore, it is inaccurate to regard the substrate 501 as a semiconductor, as currently applied in

order to form the rejection. For at least this reason, the rejection is misplaced and should be withdrawn.

Second, the metallization 502 is not "*over*" the isolation layer 601, as expressly recited in the claimed embodiments. For at least this reason, the rejection is misplaced and should be withdrawn.

Third, the flat top surface of the ball bond bump 312 is "*not*" greater than the flat bottom surface before connecting to other components. Referring to Fig. 6 of Marrs, showing the substrate 501 before connecting to other components, it is clear that the bump 312 does not overlie the metallization 502 (the bump 312 is formed on the chip side), such that there are no issues regarding flat top surface and flat bottom surface. Before connecting to other components, the solder compound of the claimed invention already overlies the UBM layer and comprises a larger flat top surface and a smaller flat bottom surface. Thus, the cited reference is totally different from the claimed embodiments.

For at least the foregoing reasons, Applicants respectfully submit that Marrs is deficient for the purpose of anticipating claims 29 and 37-38. Therefore, Applicants respectfully submit that the amended claims 29 and 37-38 are in immediate condition for allowance.

As claim 31 is a dependent claim that incorporates the features/limitations of claim 29, Applicants respectfully submit that this claim also is in condition for allowance.

35 U.S.C. 103(a)

The Office Action rejected claims 29-34, 36-38 under 35 U.S.C. 103(a) as allegedly unpatentable over Marrs (5,795,818) in view of Beddingfield (5,977,632). Applicants respectfully traverse the rejections.

As set forth above in the discussion of rejection under 35 U.S.C. 102(b), Applicants note that Marrs does not teach or otherwise disclose "the flat top surface is greater than the flat bottom surface before connecting to other components". Applicants respectfully assert that neither Beddingfield nor Marrs teaches or reasonably suggests these features. Therefore, Applicants respectfully assert that the combination of references is legally deficient for rendering these claims unpatentable.

Applicants respectfully assert that the cited references, either individually or in combination, are legally deficient for the purpose of rendering claims 29, 37-38 unpatentable. Specifically, Applicants respectfully assert that the references do not teach or reasonably suggest at least the features/limitations emphasized above in claims 29, 37-38. Therefore, Applicants respectfully assert that the amended claims 29, 37-38 are in condition for allowance.

As a separate and independent basis for traversing the 103 rejections, Applicants respectfully submit that the Office Action has failed to cite a proper motivation or suggestion for combining the cited references. In this regard, the Office Action stated that (with respect to claims 29 and 37-38) the combination of *Beddingfield* with *Marrs* would have been obvious "to promote adhesion of the solder to the passivation layer and the pad." (Office Action, p. 5). With respect to claim 30, the Office Action stated that the combination of *Beddingfield* with *Marrs* would have been obvious "to protect against the corrosion of the aluminum pads." (Office

Action, p. 5). These alleged motivations are clearly improper in view of well-established Federal Circuit precedent.

It is well-settled law that in order to properly support an obviousness rejection under 35 U.S.C. § 103, there must have been some teaching in the prior art to suggest to one skilled in the art that the claimed invention would have been obvious. W. L. Gore & Associates, Inc. v. Garlock Thomas, Inc., 721 F.2d 1540, 1551 (Fed. Cir. 1983). More significantly,

"The consistent criteria for determination of obviousness is whether the prior art would have suggested to one of ordinary skill in the art that this [invention] should be carried out and would have a reasonable likelihood of success, viewed in light of the prior art. . . . Both the suggestion and the expectation of success must be founded in the prior art, not in the applicant's disclosure. . . . In determining whether such a suggestion can fairly be gleaned from the prior art, the full field of the invention must be considered; for the person of ordinary skill in the art is charged with knowledge of the entire body of technological literature, including that which might lead away from the claimed invention."

(Emphasis added.) In re Dow Chemical Company, 837 F.2d 469, 473 (Fed. Cir. 1988).

In this regard, Applicants notes that there must not only be a suggestion to combine the functional or operational aspects of the combined references, but that the Federal Circuit also requires the prior art to suggest both the combination of elements and the structure resulting from the combination. Stiftung v. Renishaw PLC, 945 Fed.2d 1173 (Fed. Cir. 1991). Therefore, in order to sustain an obviousness rejection based upon a combination of any two or more prior art references, the prior art must properly suggest the desirability of combining the particular elements to derive a device for improving the reliability of a flip-chip, as claimed by the Applicants.

When an obviousness determination is based on multiple prior art references, there must be a showing of some "teaching, suggestion, or reason" to combine the references. Gambro Lundia AB v. Baxter Healthcare Corp., 110 F.3d 1573, 1579, 42 USPQ2d 1378, 1383 (Fed. Cir.

1997) (also noting that the “absence of such a suggestion to combine is dispositive in an obviousness determination”).

Evidence of a suggestion, teaching, or motivation to combine prior art references may flow, inter alia, from the references themselves, the knowledge of one of ordinary skill in the art, or from the nature of the problem to be solved. See In re Dembiczak, 175 F.3d 994, 1000, 50 USPQ2d 1614, 1617 (Fed. Cir. 1999). Although a reference need not expressly teach that the disclosure contained therein should be combined with another, the showing of combinability, in whatever form, must nevertheless be “clear and particular.” Dembiczak, 175 F.3d at 999, 50 USPQ2d at 1617.

If there was no motivation or suggestion to combine selective teachings from multiple prior art references, one of ordinary skill in the art would not have viewed the present invention as obvious. See In re Dance, 160 F.3d 1339, 1343, 48 USPQ2d 1635, 1637 (Fed. Cir. 1998); Gambro Lundia AB, 110 F.3d at 1579, 42 USPQ2d at 1383 (“The absence of such a suggestion to combine is dispositive in an obviousness determination.”).

Significantly, where there is no apparent disadvantage present in a particular prior art reference, then generally there can be no motivation to combine the teaching of another reference with the particular prior art reference. Winner Int'l Royalty Corp. v. Wang, No 98-1553 (Fed. Cir. January 27, 2000).

Merely identifying some benefit (from hindsight) that results from a combination is not sufficient to justify the combination, and the motivation or suggestion must come from the prior art itself, and the Office Action has failed to identify such a motivation. As stated above, the Office Action stated only that the combination of *Beddingfield* with *Marrs* would have been obvious “to promote adhesion of the solder to the passivation layer and the pad (Office Action, p.

5). Similarly, the Office Action stated only that the combination of *Beddingfield* with *Marrs* would have been obvious "to protect against the corrosion of the aluminum pads." These are not really even rationales at all. Instead, they appear only to be justifications based on the claimed utility (advanced with the benefit of hindsight). Under the approach adopted by the Office Action, it would always be possible to reject claims simply by relying on the utility of the claimed invention as providing the motivation to combine the cited references. Clearly, this approach is at odds with the well established precedence of the Federal Circuit.

For at least the additional reason that the Office Action failed to identify proper motivations or suggestions for combining the various references to properly support the rejections under 35 U.S.C. § 103, those rejections should be withdrawn.

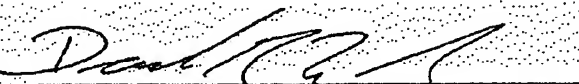
Since claims 30-34 and 36 are dependent claims that incorporate the features/limitations of claims 29, Applicants respectfully assert that these claims also are in condition for allowance.

CONCLUSION

In view of the foregoing, it is believed that all pending claims are in proper condition for allowance. If the Examiner believes that a telephone conference would expedite the examination of the above-identified patent application, the Examiner is invited to call the undersigned.

No fee is believed to be due in connection with this amendment and response to Office Action. If, however, any fee is believed to be due, you are hereby authorized to charge any such fee to deposit account No. 20-0778.

Respectfully submitted,

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